



News on LO Analog Cables

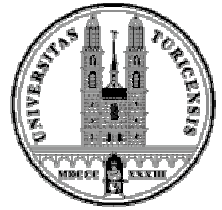


- new samples of analog cables from Dyconex received by end of February
- We ordered 5x each of the two longest cable pairs for the upcoming LO-module test:
 - S1A: 463.65 mm length, delivered: 11x
 - S1B: 461.45 mm length, delivered: 6x
 - S2A: 425.20 mm length, delivered: 12x
 - S2B: 423.00 mm length, delivered: 11x
 - plus four 'lower grade' cables for tests
- additional: received two laminated cable assemblies S2A+B

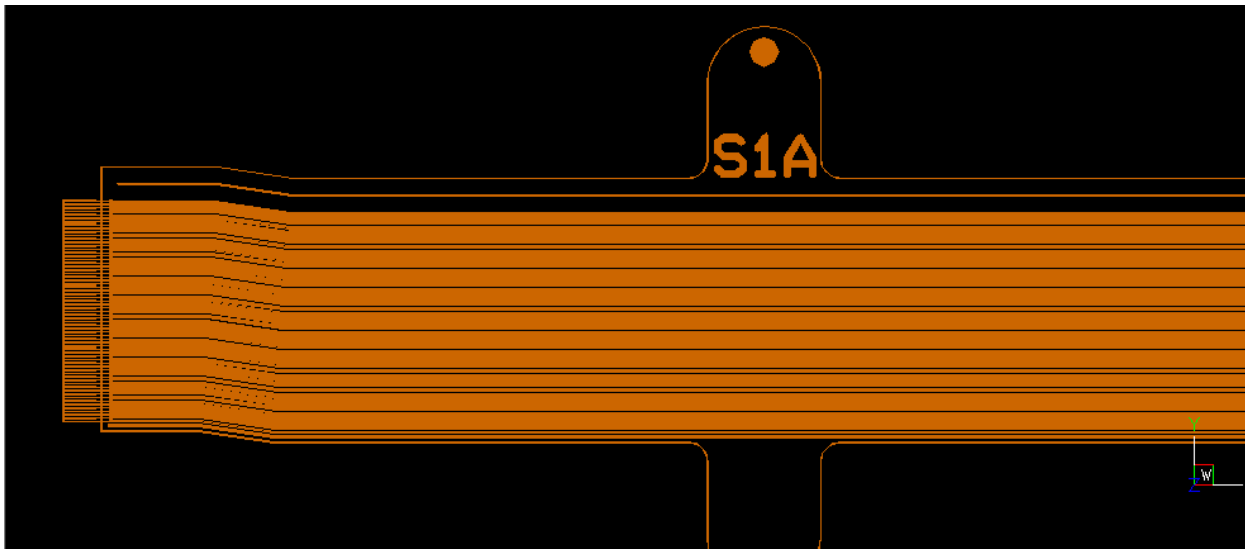
Frank Lehner
U Zurich
3/9/03



News on L0 Analog Cables



- new cable design as of Nov '02 has a "jog" at sensor side, where traces are shifted vertically by ~ 0.6 mm over a length of a few mm



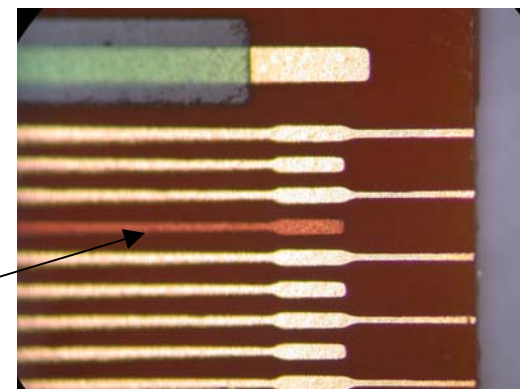


News on LO Analog Cables



- all cables are Ni-Au plated ($\sim 1.2\mu\text{m}$) over the full length, solder mask only on HV+GND traces
- did visual inspection in pad regions on all 40 cables
 - open traces would easily be identified by missing gold layer on one cable end
 - no single open trace on the 40 good ones detected

This is a picture of one of the four delivered "bad" cables

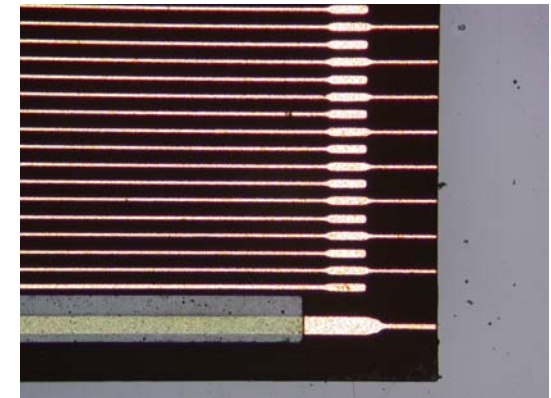
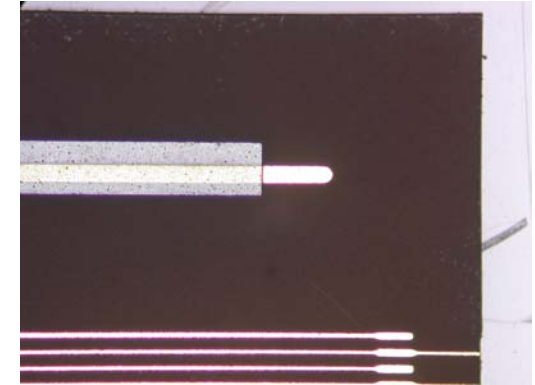
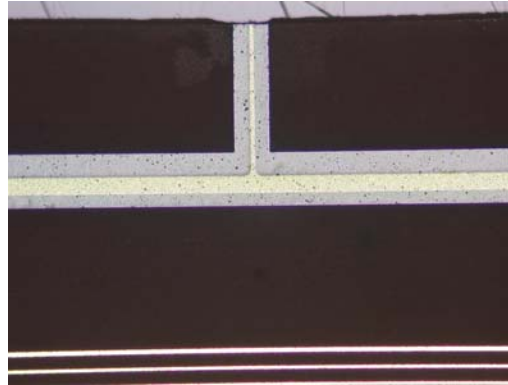




analog cables - some features



- solder mask on HV+GND trace
- rounding of HV trace
- T-connection of HV-trace to outer shortening bar
- Cu-reinforced holes at ears for fixation purposes

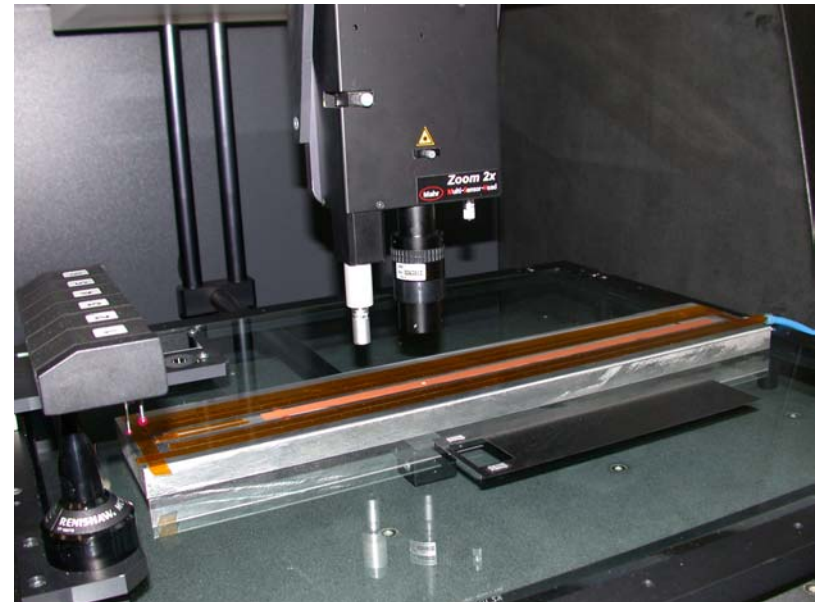
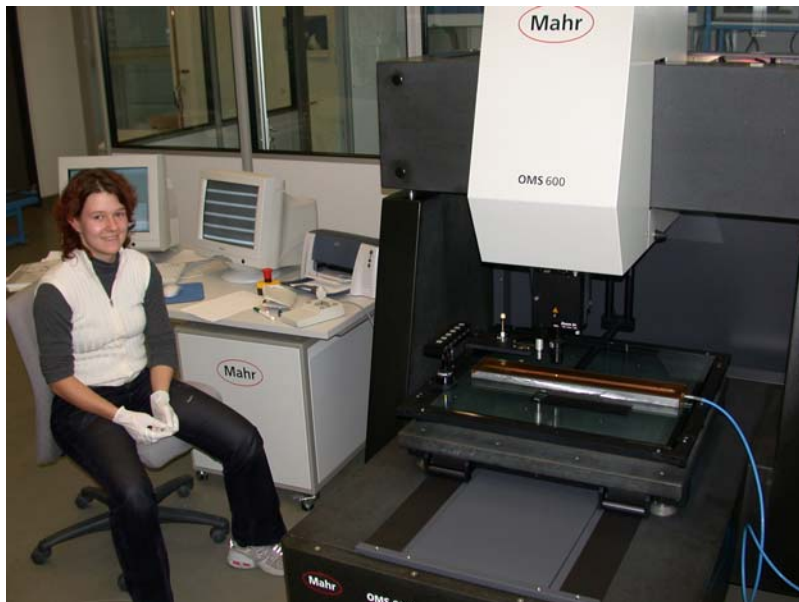




Metrology measurements

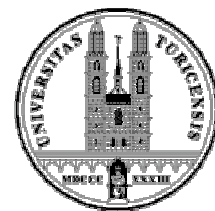


- did some optical metrology measurements in Zurich:





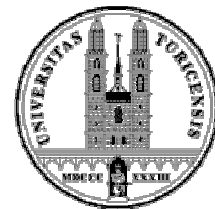
Metrology Results



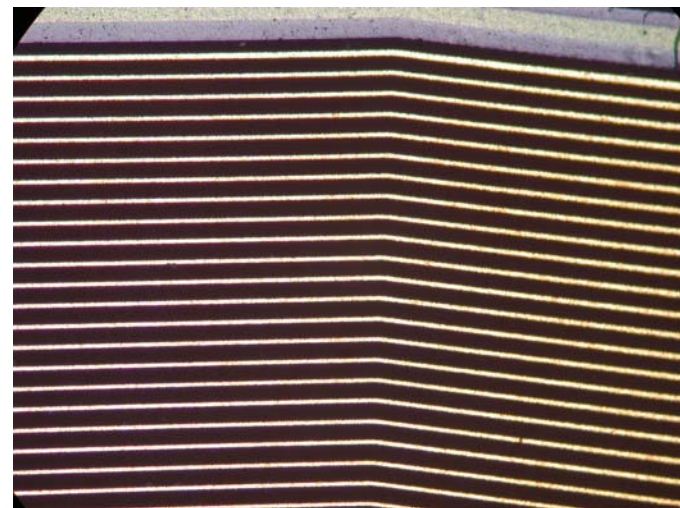
- measured only two cables of S1-A type:
 - hole diameter: 1.52 ± 0.02 mm OK!
 - hole-hole distances:
 - ✓ 413.67 ± 0.05 mm -> OK?
 - ✓ 27.27 ± 0.02 mm -> OK?
 - full length: 463.718 mm and 463.644 mm (should be 463.650 mm)
 - trace width: 19 μ m, RMS < 0.5 μ m
 - ✓ however 1st and 129th trace have thickness of ~28 μ m. Effect understood by company
 - ✓ specified 15 μ m, but could also live with 19 μ m
 - pitch: 91.5 μ m, RMS < 0.6 μ m
 - HV & GND trace width: 0.1 mm
 - pad size: 45 x 120 μ m



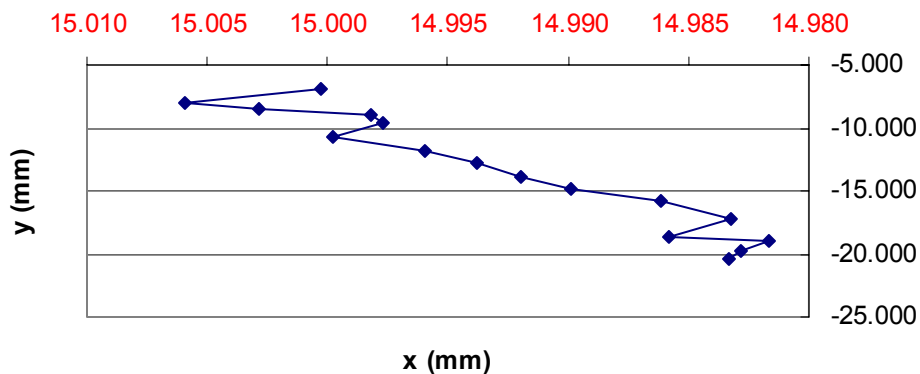
Metrology Results



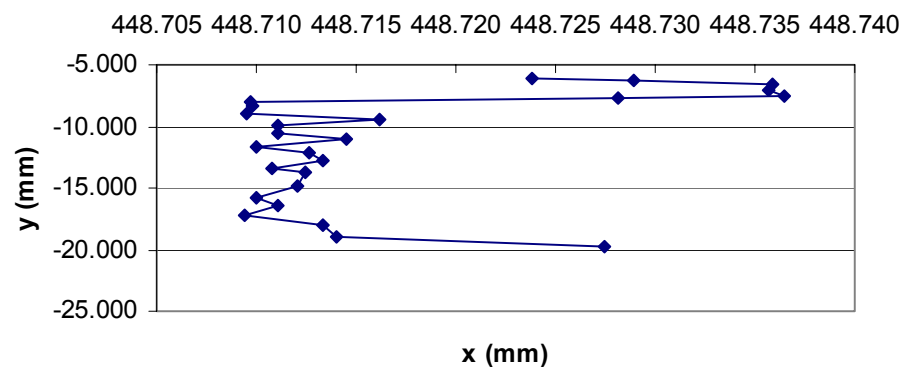
- measurement on jog
 - angle $\sim 8.5^\circ$
 - traces shifted vertically by 0.6 mm over 4.1 mm
- trimming edge accurate and parallel within $\pm 20\mu\text{m}$



trimming cable end



trimming cable end right

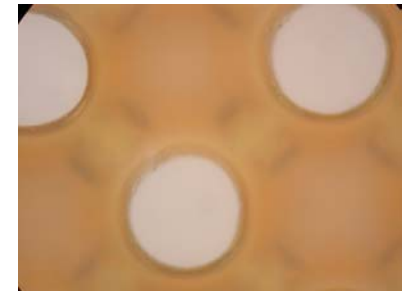
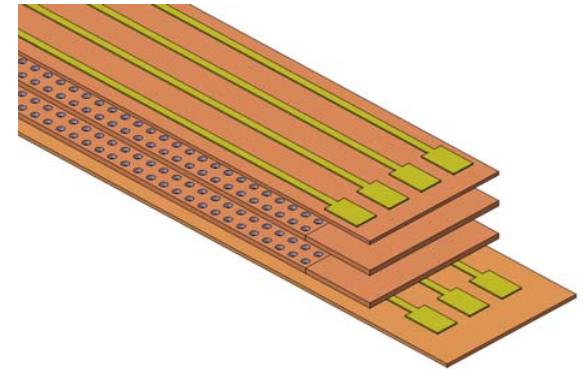




Cable assembly



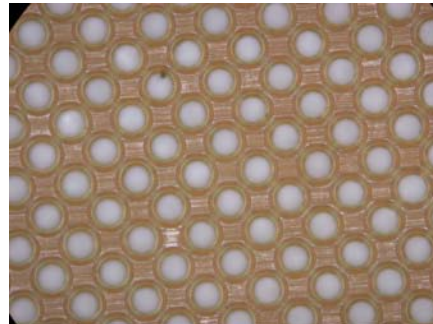
- proposal for lamination of cable pair
 - sandwich of cables and kapton mesh (kapton with plasme etched holes) to reduce dielectric constant
 - Dyconex has produced three different meshes for evaluation
 - ✓ hole radius: 60 μm
 - ✓ hole-distance: 190, 210 and 230 μm
 - ✓ corresponding to $\epsilon_r \sim 1.95, 2.2$ and 2.45



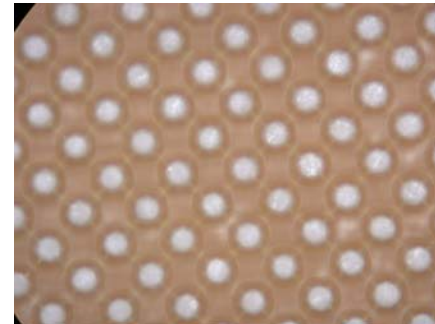
190 μm



210 μm



230 μm

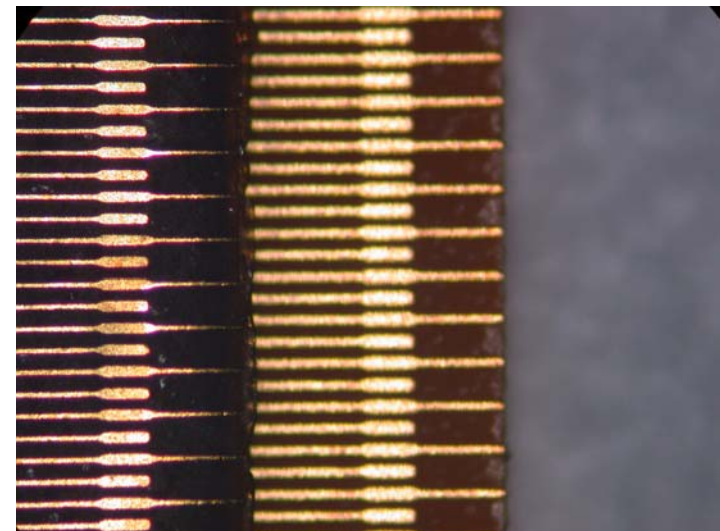
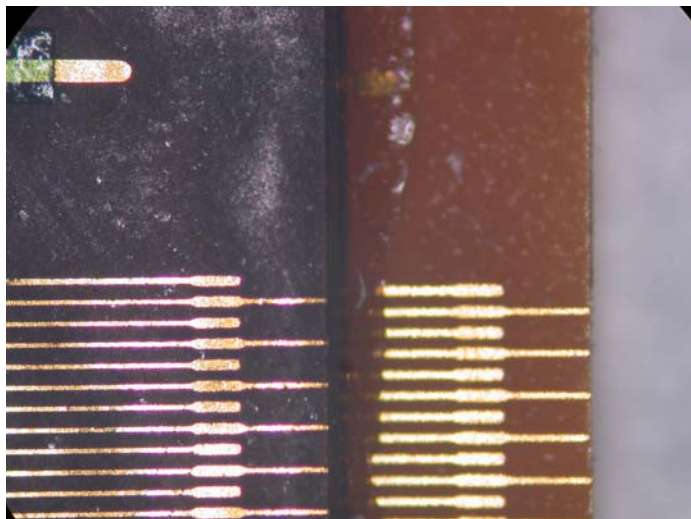
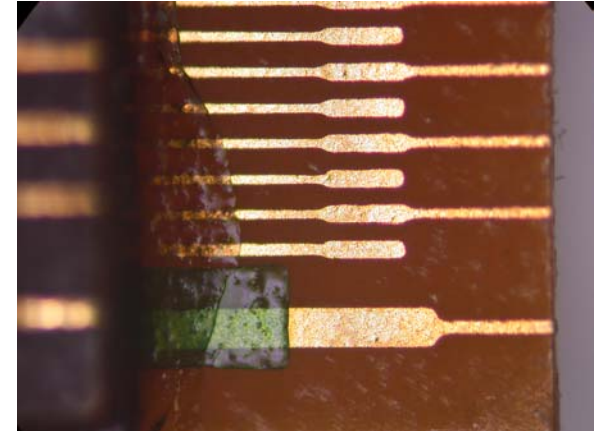




Cable assembly



- Dyconex laminated two full-size pairs of "lower grade" cables
- adhesive was applied only underneath bonding pad area
- small spots of squeezed out adhesive visible
- cable offset 1.1 mm on each side





Other issues



- Information to solder mask on HV and GND trace:
 - WPS 80 from Multiline International
 - Photo-imagable covercoat
 - dielectric constant: ~ 3.5 @ 1 MHz
 - dielectric strength: 3kV/mil
 - actual thickness $\sim 10 \mu\text{m}$
 - tested HV trace up to 500V @ 1-2 mA
- glue for lamination:
 - Pyralux LF adhesive sheets from Dupont
 - acrylic adhesive
- should we irradiate cable assembly?



Conclusions



- 40 S1-A,B and S2-A,B analog cables in hand
- excellent quality, no open trace visible
- jogged design caused no problem
- metrology results match requirements well
- Dyconex has cable production well under control
- first prototype of two laminated cable pairs produced
 - lamination process and gluing well controlled
 - have to start bonding tests on these assemblies